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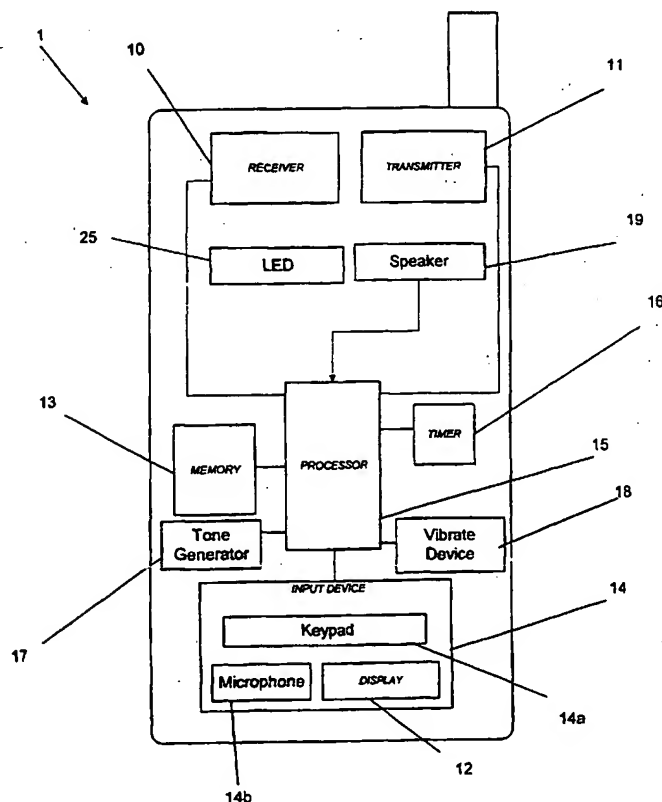
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[Continued on next page]

(54) Title: A METHOD AND APPARATUS FOR AUTOMATICALLY RECONNECTING A DROPPED CALL



(57) Abstract: The present invention encompasses an auto-connect function in a mobile terminal such as a mobile phone or personal digital assistant (PDA) with wireless communication capabilities. The mobile terminal may be configured to automatically reestablish a broken connection during a voice or data call. Also, mobile terminal is also configured to automatically establish a new connection if the initial connection has failed. When the mobile terminal is within the range of any base station, the mobile terminal automatically establishes a connection and transmits the SMS message or e-mail without further intervention from the user if the initial connection had failed.

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— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

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## **A METHOD AND APPARATUS FOR AUTOMATICALLY RECONNECTING A DROPPED CALL**

### **FIELD OF INVENTION**

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This invention relates to a method and apparatus for establishing a wireless connection for an electronic device and, more particularly, to a method and apparatus for automatically establishing a wireless connection after a broken connection in an electronic device.

### **10 BACKGROUND OF THE INVENTION**

A communication system is operable to communicate information between a transmitting station and a receiving station by way of a communication connection. A wireless communication system is a communication system in which information is communicated between the transmitting and receiving  
15 stations via one or more satellites. A cellular or digital communication system is exemplary of a multi-user wireless communication system.

Various wireless communication systems have been developed and implemented throughout large geographical areas. Wireless communication systems have been developed and implemented utilizing FDMA (frequency  
20 division multiple access), TDMA (time division multiple access), CDMA (code division multiple access), and various combinations of such communication techniques.

In a wireless communication system, base stations are used to establish and maintain a communication link (or a call) between mobile stations and other  
25 mobile or fixed stations, via satellites. The base stations communicate with one or more satellites to transmit and receive communication information (for example, data or voice information). The mobile station communicates with at least one base station; wherein, the mobile station establishes and maintains a communication connection with the base station to transmit and receive the  
30 communication information. The base station supports a plurality of mobile

stations within a geographical range. If a mobile station is within the range of a base station, then the mobile station receives a signal from the base station. A strong signal from the base station indicates a good connection and a weak signal from the base station indicates that the connection is bad. In a typical system, several base stations are used to maintain a communication link as the mobile station moves in and out of the range of a base station.

The communication systems using CDMA, TDMA, GSM, or others techniques are very robust and maintain a strong communication connection between mobile stations and base stations. However, there are times when this communication connection is broken and the call is dropped. A communication connection may be broken if an unexpected communication error occurs or the mobile station receives no base station signal. Other times the mobile station may have been moved out of the base station's range; wherein, the mobile station is not able to maintain a connection. When a call is dropped the user of the mobile phone has to manually reestablish the connection. If the call is dropped because the mobile station was moved out of base station's range, the user must continue attempting to establish a connection until the user of the mobile station is moved to a location within the base station's range. This is very inconvenient, especially when the user may not know the call is dropped. Also, depending on the situation, neither party may be able to reconnect immediately and therefore the user has to frequently attempt to reestablish the connection. Also, if the user carrying the mobile electronic device has moved out of base station's range, wherein a connection is not possible, the user must keep checking when the mobile device is able to establish a connection. This is especially inconvenient when user wants to send a data message; such as, a Short Message Sequence (SMS) or an electronic mail.

It would be useful if the mobile station can automatically reestablish a broken connection without the intervention of the user. Also, if the mobile station can automatically continue attempting to establish a connection when the initial attempt to establish a connection was unsuccessful. It would be useful if the user of the mobile station can create a data message and request the mobile

station to transmit the data message, even if the mobile station is not within the base station's range.

## SUMMARY OF INVENTION

The present invention provides a method and apparatus for an auto-connect  
5 function in a mobile terminal such as a mobile phone or personal digital  
assistant (PDA) with wireless communication capabilities. The mobile  
terminal may be configured to automatically reestablish a broken connection  
during a voice or data call. For example, if the mobile terminal has a  
communication link (an established call), and suddenly the call is dropped, the  
10 user is notified that a call was dropped and that the mobile terminal is  
attempting to reestablish the call. The user simply waits for the connection  
and begins communicating when the connection is reestablished. The  
advantage of automatically reestablishing a broken connection is that during a  
call when an existing connection between the mobile terminal and another  
15 electronic device is broken, the mobile terminal reestablishes the connection  
with the same electronic device without the intervention from the user.

The mobile terminal is also configured to automatically establish a new  
connection if the initial connection has failed. For example, if the user  
20 attempts to establish a call and fails, the mobile terminal will continue  
attempting to establish the call. The advantage is that the user can send a  
previously created SMS message or e-mail even if the mobile terminal is out  
of base station's range wherein a connection is not possible. When the mobile  
terminal is within the range of any base station, the mobile terminal  
25 automatically establishes a connection and transmits the SMS message or e-  
mail without further intervention from the user.

A more complete appreciation of all the advantages and scope of the present  
invention can be obtained from the accompanying drawings, the following  
30 detailed description of the invention, and the appended claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a block diagram of a mobile station into which an embodiment of the invention may be implemented;

FIG. 2 shows a process connection terminal software module depiction of an embodiment of the invention.

5        FIG. 3 shows an initiate call sequence software module depiction of an embodiment of the invention.

#### DETAIL DESCRIPTION OF THE INVENTION

FIG. 1 is a block diagram of the mobile station 1, according to an embodiment of the invention. Generally, mobile station 1 includes receiver  
10    10, transmitter 11, and controller (which may also be known as a processor)  
15    15 that is coupled to transmitter 11 and receiver 10. Processor 15 initiates the transmission of outgoing signals and processes incoming signals. These signals may include signaling information in accordance with the air interface of the applicable cellular or digital system, and also user speech and/or user generated data.

A user interface includes a Liquid Crystal Display (LCD) 12 which comprises a touch-screen display, tone generator 17, speaker 19, vibrate device 18 and user input device 14 comprising keypad 14a, all of which are coupled to processor 15. The input device may also comprise microphone  
20    14b for generating input. The input device may further include the touch-screen display 12. Mobile station 1 also comprises timer 16 (also referred to as a clock chip) coupled to processor 15 for synchronizing the operations of processor 15 and tracking time.

Mobile station 1 also includes various memories, shown collectively as  
25    memory 13. Memory 13 includes a plurality of stored constants and variables that are used by processor 15 during the operation of mobile station 1. For example, memory 13 stores the values of the various feature parameters and the number assignment module (NAM). An operating program for controlling the operation of processor 15 is also stored in memory 13 (typically in a read  
30    only memory). Memory 13 is also used to store data provided by the user through the user interface. Furthermore, memory 13 is used to hold the

subprograms or sub-processes for controlling the operation of mobile station 1 and carrying out the embodiment of the invention. The operating program in memory 13 includes routines for auto-connect function according to an embodiment of the invention.

5 Referring now to FIG 2 for illustrating a process connection termination task 200 is activated when a connection is terminated. Task 200 is activated when a connection between a mobile station 1 and another electronic device, such as a base station, is terminated and the user has selected an auto-connect feature of the mobile phone. At block 202, the processor 15  
10 determines if the existing connection was terminated by the user by actuating a terminate connection function of the mobile station 1 (for example, actuating a "end" key on the keypad). If yes, then no further action is performed by task 200. Otherwise, at block 204, the processor 15 accesses a communication link information, such as the phone number, of the terminate communication  
15 link. If the user had initiate the last connection, then the processor 15 can access the connection information, for example a phone number of the last (or broken) connection from the memory 13. If the last connection was established by another electronic device (calling party), then depending on the communication system, the processor 15 may access the phone from the  
20 base station or service provider. Also, mobile phone 1 may comprise a caller-id feature, wherein the processor 15 may acquire the phone number from the memory 13. In the preferred embodiment, the phone number information is received from the service provider and stored in the memory 13 of the mobile phone 1 when the when call is not initiated by the user. If the user initiates  
25 the call, the phone number is stored in memory 13 of the mobile station 1 prior to a terminated connection. At block 206, the processor 15 calls initiate call sequence task 300, described below, to re-establish the terminated connection. For example, the processor 15 may automatically activate the same activation feature manually activated by user to establish a new  
30 connection or re-connect to the last connection.

Reference is made to FIG 3 for illustrating an initiate call (or communication link) sequence task 300. The task 300 is activated when the

user actuates a function of the mobile station 1 for sending voice or data. Task 300 may also be activated by process connection termination task 200 (described above) when a connection is terminated. One use of task 300 is that the user may create a data message and enter an address (for example, a phone number) of the recipient and actuate the send data function. The initiate call sequence task 300 will automatically attempt to establish the connection without further intervention from the user. This is very useful when the mobile station 1 is out of base station's range and does not receive a base station signal. As described below, the initiate call sequence task 300 will continue attempting to establish the connection until a connection is established or the user interrupts the task 300. At block 302, the processor 15 determines if a connection is possible. The processor 15 may check the signal strength received from the base station. If the connection is possible, then at block 304, the processor 15 uses the previously entered communication link information (for example, a phone number) from the memory 13 to establish a communication link. At block 306, the processor 15 determines if the communication link (for example, the call) was established. The communication link may comprise a link between the mobile station 1 to another electronic device via a connection to at least one base station. At block 308, the processor 15 determines if this sequence was activated for a voice or data call. If this was a data call, at block 309a the processor 15 transmits the data (SMS or e-mail) when the connection is established. However, if this was a voice call, then at block 309b the processor 15 notifies the user that the call is established. The processor 15 may notify user by flashing a light emitting diode (LED) 25, flashing graphical symbols on the display 12, beeping using the speaker 19 or generate a predetermined tone sequence using the tone generator 17. In a preferred embodiment, the processor 15 generates a plurality of tones using the tone generator 17 to notify the user. If the connection was not established, then at block 310, the processor 15 waits for predetermine time period. When the time period expires, at block 314, the processor 15 re-initiates the send data task 300. Referring back to block 302, if the processor 15 determines that a connection is not possible (for example, no base station signal available), then at block



316, the processor 15 waits for predetermined time period. When the time period expires, then at block 320, the processor 15 re-initiates the send data task 300. The processor 15 continues this cycle until a successful connection is established and the data or voice is transmitted. Note that the user may  
5 interrupt this sequence at any time by actuating a terminate function of the mobile phone.

As examples, the method and apparatus may also be implemented in electronic devices such as PDA, GPS devices, landline telephones, computers, and other devices having a wireless connection system. The  
10 method and apparatus may be realized by implementing operating mode such as auto-connect mode, which may be modified by the user using a menu feature.

Thus, while the invention has been particularly shown and described with respect to preferred embodiments thereof, it will be understood by those skilled  
15 in the art that changes in form and scope may be made thereon without departing from the scope and spirit of the invention.

## CLAIMS

What is claimed is:

- 1 1. An electronic device having an auto connect function to establish a  
2 communication link after a broken connection, said electronic device  
3 comprising:  
4 a processor, for detecting the broken connection; and  
5 said processor, further acquiring a communication link information of  
6 the broken connection and said processor initiating a communication  
7 link sequence to establish the communication link using said  
8 communication link information.
- 1 2. The electronic device in accordance with claim 1, further comprising;  
2 a memory, for storing said communication link information, coupled to  
3 said processor;  
4 said processor further storing said communication link information in  
5 said memory prior to the broken connection and accessing said  
6 communication link information from said memory after the broken  
7 connection.
- 1 3. The electronic device in accordance with claim 2, wherein,  
2 the communication link comprises a connection to a base station;  
3 said processor, further for determining if the connection to the base station  
4 is possible before establishing the communication link; and  
5 said processor attempting to establish the communication link if the  
6 connection to the base station is possible; otherwise said processor re-  
7 initiating the communication link sequence if the connection to the base  
8 station is not possible;  
9
- 1 4. An electronic device in accordance with claim 3, wherein said processor  
2 transmitting data stored in said memory if the communication link was  
3 established for transmitting a data message.

1 5. An electronic device in accordance with claim 3, wherein said processor  
2 notifying the user using a tone generator to generate a plurality of tones, if the  
3 communication link was established for transmitting voice.

1 6. An electronic device in accordance with claim 3, wherein said processor  
2 waiting for a predetermined time period before re-initiating the communication  
3 link sequence.

1 7. An electronic device in accordance with claim 3, wherein the electronic  
2 device comprises a mobile phone.

1 8. An electronic device in accordance with claim 3, wherein the electronic  
2 device comprises a personal digital assistant.

1  
2 9. A method for establishing a communication link after a broken connection,  
3 said method comprising steps of:

4 detecting the broken connection;  
5 acquiring a communication link information of the broken connection;  
6 and  
7 initiating a communication link sequence to establish the  
8 communication link using said communication link information.

1 10. The method of claim 9, further comprising steps of:  
2 storing said communication link information into a memory prior to the  
3 detecting the broken connection;  
4 accessing said communication link information from said memory after  
5 detecting the broken connection.

1 11. The method of claim 10, wherein the step of initiating a communication  
2 link sequence further comprising steps of:  
3 determining if the connection to a base station is possible before  
4 establishing the communication link.

1 12. The method of claim 11, further comprising step of establishing the  
2 communication link if the connection to the base station is possible;

1 13. The method of claim 12, further comprising a step of transmitting data  
2 stored in the memory if the communication link was established for  
3 transmitting a data message.

1 14. The method of claim 12, further comprising a step of notifying the user if  
2 the communication link was established for transmitting voice.

1 15. The method of claim 11, further comprising a step of re-initiating the  
2 communication link sequence if the connection to the base station is not  
3 possible;

1 16. The method of claim 15, further comprising steps of waiting for a  
2 predetermined time period before re-initiating the communication link  
3 sequence.

1 17. An electronic device having an auto connect function to establish a  
2 communication link after a broken connection, said electronic device  
3 comprising:

4 a memory comprising an operating program; and  
5 the operating program comprising steps of,  
6 detecting the broken connection;  
7 acquiring a communication link information of the broken connection;  
8 and  
9 initiating a communication link sequence to establish the  
10 communication link using said communication link information.

1 18. The electronic device accordance with claim 17, wherein,  
2 the operating program further comprising steps of;  
3 storing said communication link information into said memory  
4 prior to the detecting the broken connection;

5                   accessing said communication link information from said  
6                   memory after detecting the broken connection.

1    19. The electronic device in accordance with claim 18, wherein, the operating  
2    program having the step of initiating a communication link sequence further  
3    comprises a step of determining if the connection to a base station is possible  
4    before establishing the communication link.

1    20. The electronic device in accordance with claim 19, wherein, the operating  
2    program further comprising a step of establishing the communication link if the  
3    connection to the base station is possible;

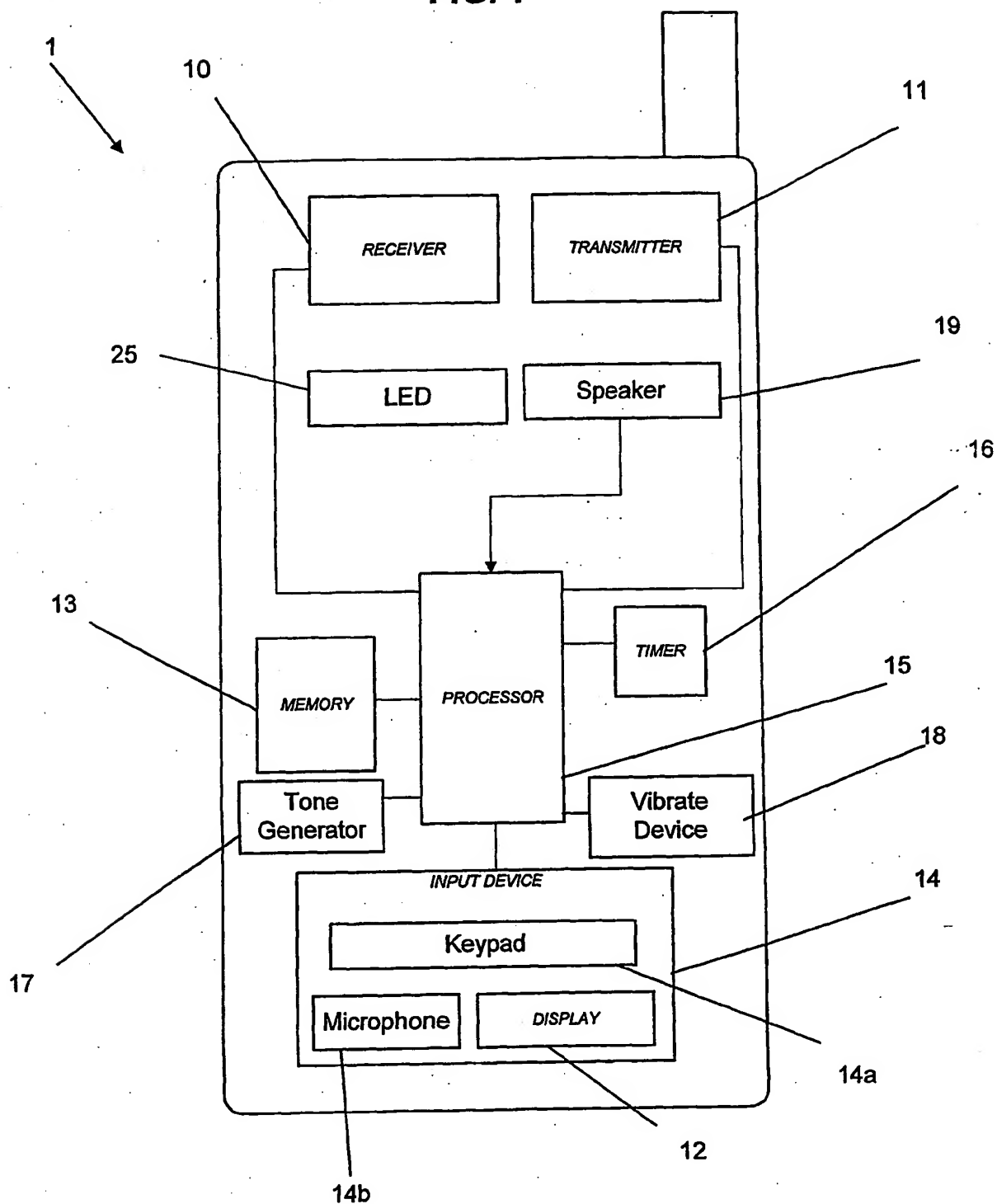
1    21. The electronic device in accordance with claim 20, wherein, the operating  
2    program further comprising a step of transmitting data stored in the memory if  
3    the communication link was established for transmitting a data message.

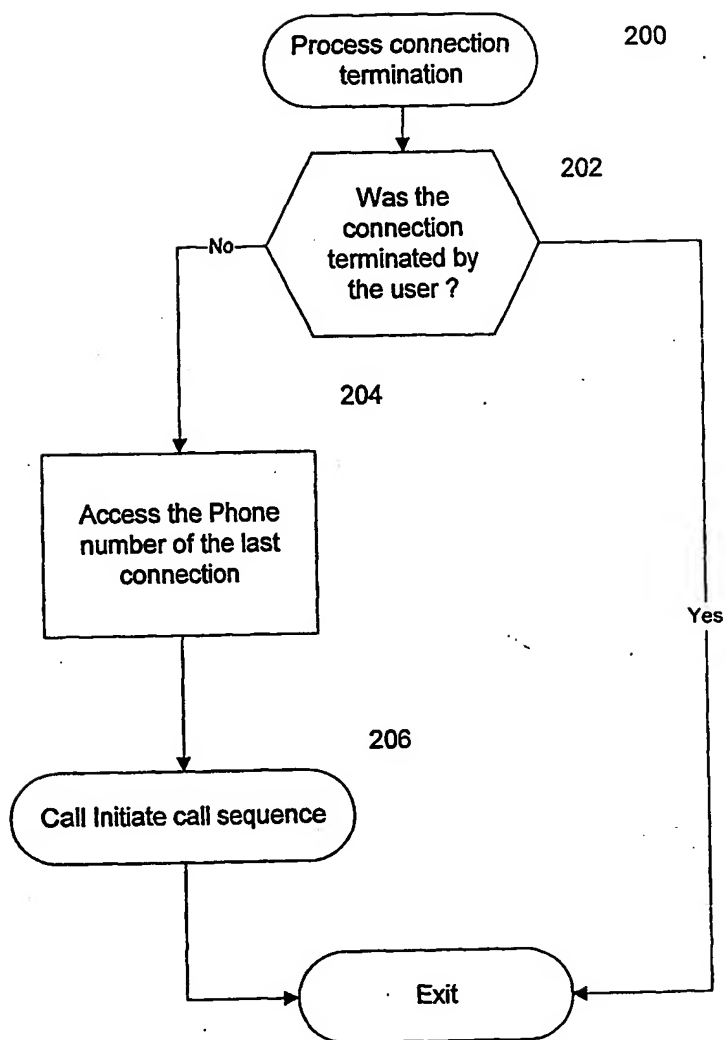
1    22. The electronic device in accordance with claim 20, wherein, the operating  
2    program further comprising step of notifying the user if the communication link  
3    was established for transmitting voice.

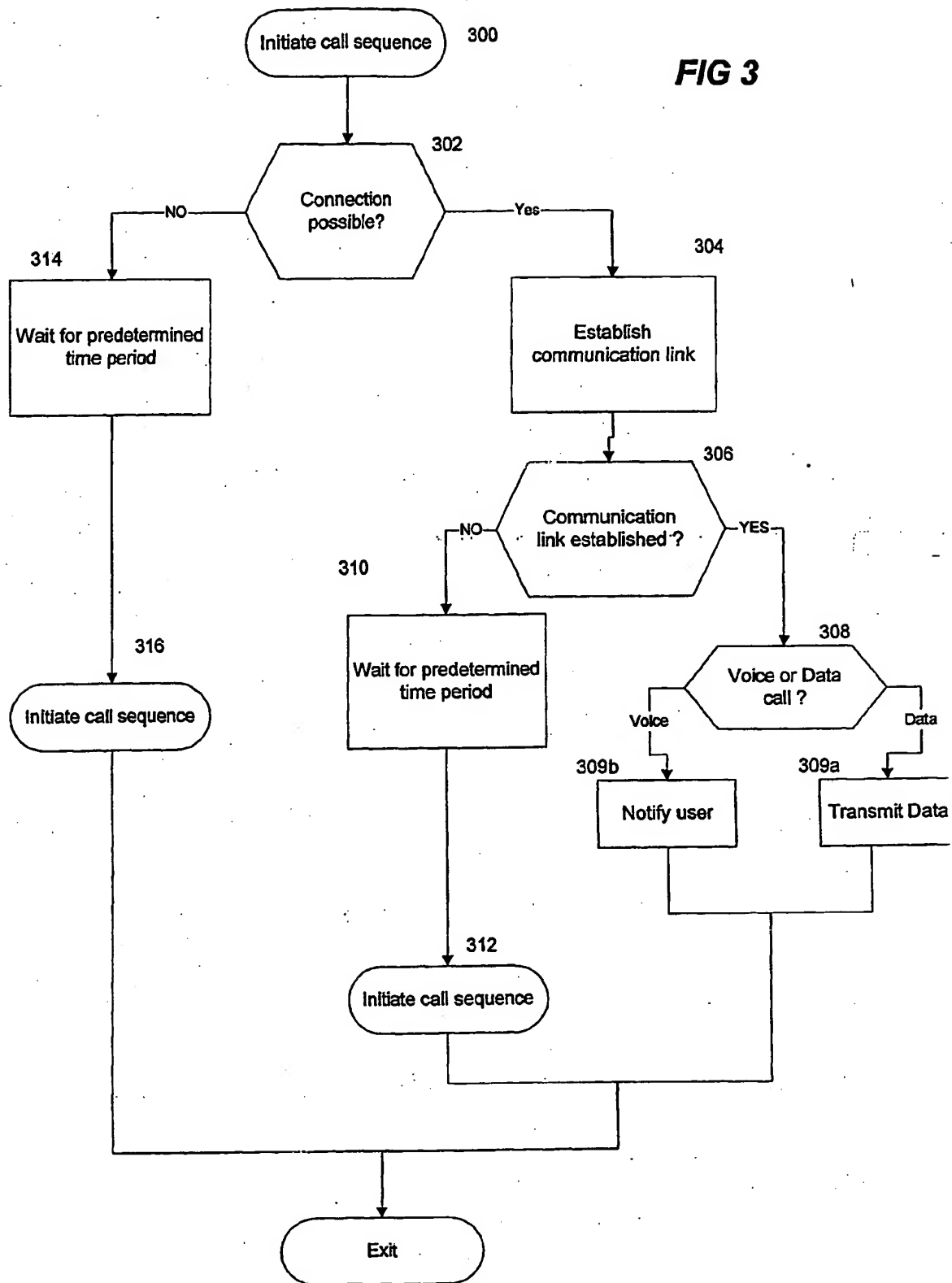
1    23. The electronic device in accordance with claim 19, wherein, the operating  
2    program further comprising a step of re-initiating the communication link  
3    sequence if the connection to the base station is not possible.

24. The electronic device in accordance with claim 23, wherein, the operating  
5    program further comprising steps of waiting for a predetermined time period  
before re-initiating the communication link sequence.

**FIG. 1**



**FIG 2**

**FIG 3**



# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 01/18610

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 327 017 A (MATSUSHITA ELECTRIC IND CO LTD) 6 January 1999 (1999-01-06)  page 2, line 25 -page 3, line 13 claims 1,2	1-3, 9-12, 17-20
X	US 5 239 571 A (TAKAHASHI SHINYA) 24 August 1993 (1993-08-24) column 1, line 46 -column 2, line 33 claims 1,4	1,2,9, 10,17,18

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
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- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*G\* document member of the same patent family

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Information on patent family members

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